ENERGY R&D

A TECHNOLOGY STATUS REPORT ENERGY USAGE AND MICROWAVE HEATING POTENTIAL IN ONTARIO CERAMICS INDUSTRIES

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EXECUTIVE SUMMARY

A number of ceramic manufacturing companies have applied, to the Ontario Ministry of Energy through the EnerSearch Program, for the funding of research and development on microwave heating processes. To assess the potential impact of microwave technology on energy use, an energy survey of the ceramics industry in Ontario was undertaken.

A total of 209 companies were identified as manufacturers of ceramics. The industry operates 276 kilns with energy usage estimated at 1.89 petajoules for the drying and firing processes.

The application of microwave energy to current ceramics manufacturing processes can increase product throughput while reducing energy costs, tooling, floor space, and and materials handling. If microwave technology were to replace existing conventional process heating equipment within the ceramics industry, the potential annual energy savings would be 1.5 petajoules.

Survey results indicate that the ceramics industry is an important and growing industry in Ontario. In particular, a significant growth in energy consumption may occur within the advanced ceramics industry. The implementation of microwave technology may have a positive impact on this industry.

ENERGY USAGE AND MICROWAVE HEATING POTENTIAL IN ONTARIO CERAMICS INDUSTRIES

INTRODUCTION

The manufacturing of ceramics is labour, time and energy intensive involving the processes of drying, sintering and often the bonding of ceramics to other materials. Microwave heating is an energy efficient technology suitable to these processes, in the manufacturing of traditional and advanced ceramics.

A number of ceramics manufacturing companies have contacted the Ministry of Energy, through the EnerSearch Program, for the funding of innovative microwave heating applications to various production processes. In order to estimate the energy savings and to understand the market potential of microwave technology within the ceramics industries, the Ministry of Energy conducted an industry-wide survey of Ontario ceramics manufacturing companies.

Ceramics manufacturing consists of the following industry groups:

Traditional ceramics

- Abrasives
- Brick and tile
- Electrical porcelain
- Enamel
- Glass
- Pottery and whiteware
- Refractories
- Sanitaryware
- Structural clay

Advanced ceramics

- Mechanical/structural
- Thermal
- Electronic/electrical
- Chemical
- Magnetic
- Optical
- Biological

The ceramics industry forms a part of the Industrial Minerals industry sector (1) that includes:

- Abrasives
- Asbestos
- Cement
- Clay Brick
- Concrete Products
- Glass
- Lime
- Refractories

Energy consumption within this industry sector was approximately 80 Petajoules (PJ) in 1984, representing almost ten percent of the Canadian industrial energy share.

A list of ceramics plants, published in the 1975 Operator's list (2), indicated a total of 185 operating plants in Canada, of which 112 plants were located in Ontario.

In 1978, (the last publication year of the Operators' List), 220 Canadian ceramics plants were listed of which 129 resided in Ontario (3). While new companies emerged, a large number of plants ceased operation due to construction industry slow-downs, research cutbacks and offshore competition.

A number of recent publications (4,5,6,7) have provided a broad overview of the Canadian ceramics industry. One publication listed Canadian companies either manufacturing or with the capability of entering into the manufacturing of advanced ceramics (8). However, the current size of the ceramics industries has not been published.

The scope of this report is to identify existing ceramics manufacturing companies in Ontario, estimate energy usage within the various ceramics industries and estimate the energy impact of microwave technology.

The industry sectors representing abrasives and glass form a part of the Industrial Minerals Task Force under the Canadian Industry Program for Energy Conservation (CIPEC). The Task Force has compiled an extensive database on energy consumption within these industries. As such, energy data for this report was not gathered on the abrasives, glass or enamel industries. Energy data was collected for those ceramic industries for which microwave technology was considered feasible. Abrasives manufacturers are listed in Appendix A, glass manufacturers are listed in Appendix B, and enameling companies are listed in Appendix C.

PROCEDURES

The following sources and publications have been used to develop a list of existing ceramics manufacturers in Ontario:

- Scott's Directory, Ontario Manufacturers, 15th Edition, 1985; 16th Edition, 1986;
- Fraser's Canadian Trade Directory, 1986;

- Made in Ontario, 1986;
- Canadian Ceramic Society Roster, 1986;
- Transactions of the Canadian University - Industry Council on Advanced Ceramics (CUICAC).

In developing data for the report, information on branch plants was compiled and treated as a single company.

Ceramics manufacturers were contacted by telephone and asked to provide the following information:

- Number of employees;
- Type of products manufactured;
- Type of processes used;
- Number of kilns used;
- Fuel type used;
- Hours of operation.

Manufacturers of advanced ceramics were asked to provide additional information related to:

- Type of powder used;
- Per cent of powder imported;
- Future market potential anticipated.

SURVEY RESULTS

A total of 564 companies are listed in the various directories as manufacturers, users or distributors of ceramic/glass materials (Table 1). Of the manufacturing companies, follow-up telephone contact failed to reach 45 listed companies and these are assumed to have ceased operation, (Appendix D). Five companies contacted are no longer involved in ceramics. Of the 514 active companies, 209 are manufacturers, 215 are users and 78 are agents or distributors of ceramics or glass (Appendix E). Table 2 lists the number of companies in the various ceramics manufacturing industries.

Brick and Tile

Nine brick and tile manufacturers have been identified in Ontario (Table 3), ranging in size from 10 to 410 employees. Total employment in this sector is estimated at 1,038 people (Table 4). Combined, the companies manufacture 437 million bricks, 10 million square feet of floor tile and in excess of 9 million pieces of drainage tiles annually. The principal production method is extrusion. The industry operates 44 kilns (tunnel and periodic type), of which 42 are fired by natural gas and two are oil-fired. Energy consumption in this sector is estimated at 255 million kWh per year.

Electrical Procelain

There are five companies identified as manufacturers of electrical porcelain in Ontario (Table 5). These companies range in size from 11 to 250 people with total employment estimated at 691 people (Table 6). Insulators, capacitors and resistors are among the products manufactured in this sector. Total sales for two companies responding to the survey are $10.2 million annually. Principal processes include dry pressing and extrusion. The industry operates seven natural gas-fired kilns with annual energy consumption estimated at 16 million kWh.

Pottery Industry (Large)

This category consists of 14 companies that employ 10 or more people (Table 7). Companies range in size from 10 to 84 people with total employment estimated at 423. The industry manufactures a variety of products that include giftware, lamps and whiteware. The predominant production process is slip casting. Data from six responding companies indicates an annual production of about 0.5 million pieces (Table 8). The industry operates 68 kilns, of which one is natural gas-fired, the remaining 67 kilns are electric. Energy consumption in this sector is estimated at 7.07 million kWh annually.

Pottery Industry (Medium)*

This category consists of 12 companies that employ four to ten people, (Table 9). Total employment in this category is estimated at 70. The industry manufactures a variety of products including figurines, earthenware and whiteware (Table 10). The industry operates 48 kilns, of which 46 are electric, one is propane-fired and one is fired by natural gas. Energy consumption in this sector is estimated at 1.82 million kWh annually.

Pottery Industry (Small)

The small pottery category includes 38 listed companies that employ less than 4 people (Table 11). It is suspected that there are many small pottery establishments in operation that have not been listed in the various directories. No data was collected for this group.

*These companies are listed in the Ministry of Natural Resources publication "The Clay and Shale Industries of Ontario" as small industries. For the purpose of developing energy data, in this publication, the companies are considered medium.

Refractories

Thirteen refractory manufacturers have been identified in Ontario (Table 12). Companies range in size from five to 123 employees. Total employment is estimated at 695 people, (Table 13). Refractory products consist of castables, firebricks, plastics and coatings. In excess of one million tonnes of product are manufactured annually. Energy data was derived from five responding companies. The companies operate 15 kilns, nine of which are fired by natural gas and six are electric. Energy consumption is estimated at 49 million kWh annually.

Sanitaryware

Four companies in Ontario manufacture sanitaryware products (Table 14). The companies range in size from 30 to 400 employees (Table 15). Total employment is estimated at 791 people. The companies sell approximately 3,782,000 units consisting of bathroom fixtures, tubs, toilets and basins. The predominant production process is slip casting. The companies operate 15 kilns, 24 hours per day. These include nine natural gas-fired and six electric units consuming approximately 114 million kWh per year.

Glazes

This category consists of eight companies manufacturing a variety of specialized products (Table 16). Companies range in size from eight to 150 people (Table 17). Total employment for this industry group is estimated to exceed 360 people. Manufactured products include glazes, glass coatings, powders and decorative materials. The industry operates 21 kilns, 19 of which are natural gas-fired and two are electric. Annual energy consumption is estimated at 75.6 million kWh.

Others

This category includes 35 listed companies with some involvement in ceramics (Table 18). No data was collected for this group.

ADVANCED CERAMICS

In Ontario, there are 13 companies identified as manufacturers of advanced ceramics (Table 19). The companies range in size from five to 880 people with total employment estimated at 1364 people (Table 20).

The advanced ceramics companies consist of eight firms manufacturing electrical or electronic ceramics, two firms

manufacturing mechanical/structural ceramics and two companies producing powders. One company has been identified in the manufacturing of plasma coatings, however, no additional data is available for this firm.

Powders utilized in manufacturing include the following:

- Alumina
- Boron Carbide
- Boron Nitride
- Feldspar
- Titanium Diboride
- Ferrite
- Lead Titanate
- Silicon Carbide
- Silicon Nitride
- Lead Zirconate

Five companies import 100% of their powder and two companies import about 80% of their powder. Two companies use domestic powder sources.

Processes used within the advanced ceramics industry sector vary and include the following:

- Slip Casting
- Extrusion
- Dry Pressing
- Cold Pressing
- Injection Moulding
- Hot-Isostatic Pressing
- Pressure Sintering

Process energy consumption is difficult to establish for several reasons:

- Energy data is not collected by industry;
- Hours of kiln operation may be variable;
- Kilns are designed to particular specifications.

A total of 58 kilns, of which 14 are fired by natural gas and 44 are electric, are operated by the industry. Operating hours tend to be variable ranging between 12 hours per week to 24 hours per day.

Four companies provided some workable energy data. Based on 250 working days per year, energy consumption was estimated at 5.9 million kWh/year.

The current market for Ontario-based, advanced ceramics companies is estimated at $4.75 million. Six companies speculated on the potential market growth, based on projected annual sales between 1992-1997 (Exhibit 1). The total market anticipated is estimated at $1.35 billion annually. In Ontario, the market is expected to increase to $10.5 million annually and $15.9 million nationally. The predominant market is aimed at the U.S., with an estimated value of $441 million, but possibly as high as $941 million.

The world market for advanced ceramics is estimated at $30 billion annually by the year 2000-2010. The anticipated U.S. share of the world market is estimated at about $18 billion annually.

EXHIBIT 1: MARKET POTENTIAL FOR ONTARIO MANUFACTURERS OF ADVANCED CERAMICS (1992-1997) (PROJECTED ANNUAL SALES)

($ MILLION)

	ONTARIO	CANADA	USA	OTHER	TOTAL
A	5.0	-	-	-	505.0
B	-	0.1	30.0	-	30.1
C	1.0	2.5	2.5	0.5	6.5
D	-	1.0	70.0	130.0	201.0
E	-	0.8	-	-	0.8
F	3.0	8.0	300.0	250.0	561.0
G	1.5	3.1	39.0	5.0	49.0
TOTAL	**10.5**	**15.9**	**441.5**	**385.5**	**1,353.4**

It is generally accepted that the Canadian market in advanced ceramics represents about 10 per cent of the US market level in advanced ceramics. The Canadian market can be estimated at $1.8 billion annually by 1997. In terms of world market potential, the Canadian share is estimated between 4.5 per cent to 6.0 per cent.

Companies identified as users of advanced ceramics or industrial ceramics are listed in Table 19. Several publications have listed companies with the potential to enter into advanced ceramics manufacturing. The names of these companies have been compiled and are given in Table 20.

Advanced ceramics are anticipated to develop a particular market niche within the automotive industry, as engine components. In Ontario, there are 142 automotive parts manufacturers (Exhibit 2). The status of automotive advanced ceramics within this industry group is not known.

EXHIBIT 2: AUTOMOTIVE PARTS MANUFACTURERS

Motor vehicle engines	9
Motor vehicle diesel engine parts	12
Motor vehicle engine parts	39
Motor vehicle non-engine parts	82
Total	**142**

ENERGY USE IN CERAMICS PROCESSING

A summary of industry kiln use and annual energy consumption is given in Exhibits 3 and 4 respectively. Estimated annual energy consumption within the ceramics industry is 524.6 million kWh (1.89 PJ).

EXHIBIT 3: CERAMICS INDUSTRY KILN USE

	Total Kilns	Electric Kilns	Gas Kilns	Other Kilns
Brick and Tile	44	-	42	2
Electrical Porcelain	7	-	7	-
Glazes	21	2	19	-
Pottery	116	112	3	1
Refractories	15	6	9	-
Sanitaryware	15	6	9	-
Advanced Ceramics	58	44	14	-
TOTAL	**276**	**170**	**103**	**3**

EXHIBIT 4: CERAMICS INDUSTRY ENERGY CONSUMPTION (Annual) (Million kWh)

	Total	Natural Gas	Electric	Other
Brick and Tile	255.00	245.34	-	9.66
Electrical Porcelain	16.00	16.00	-	-
Glazes	75.60	62.00	13.60	-
Pottery	8.90	0.17	8.57	0.15
Refractories	49.40	46.50	2.90	-
Sanitaryware	113.80	96.10	17.70	-
Advanced Ceramics	5.90	3.96	1.96	-
TOTAL (kWh)	**524.60**	**470.07**	**44.73**	**9.81**
(PJ)	**1.89**	**1.69**	**0.16**	**NEG**

Process energy within the ceramics industry is primarily used for drying and firing. Typically, drying accounts for 22 per cent of the energy used and firing accounts for 64 per cent of the energy used. It is anticipated that microwave technology will save up to 50 per cent of the conventional drying energy usage and microwave firing will save up to 90 per cent of conventional firing energy consumption (Exhibit 5).

EXHIBJT 5: MICROWAVE ENERGY SAVINGS POTENTIAL IN CERAMICS MANUFACTURING

(MILLION kWh/YEAR)

	Conventional Drying	Microwave Drying	Conventional Firing	Microwave Firing	Total Energy Savings
Brick & tile	56.10	28.05	198.90	19.90	207.06
Electrical Porcelain	3.52	1.76	12.48	1.25	12.99
Glazes	16.63	8.30	58.97	5.89	61.37
Pottery	1.96	0.98	6.94	0.69	7.23
Refractories	10.87	5.40	38.53	3.85	40.08
Sanitaryware	25.04	12.52	88.76	8.88	92.40
Advanced Ceramics	1.30	0.65	4.60	0.46	4.79
Total (kWh)	**115.42**	**57.66**	**409.18**	**40.92**	**425.92**
(PJ)	**0.42**	**0.21**	**1.47**	**0.15**	**1.50**

CERAMICS INDUSTRY ENERGY TRENDS

Current process energy consumption within the ceramics industry is estimated at 1.89PJ. Using an industry energy growth rate of 2.6 per cent annually and an energy savings potential of 1.3 per cent annually, (CIPEC 1984) anticipated energy consumption will be approximately 2.2 PJ by the year 2000.

Current process energy use in advanced ceramics is estimated at 0.002 PJ representing 0.001 per cent of the ceramics industry energy share. Based on an industry growth rate of 506 per cent (13 companies to 76 companies consisting primarily of non-ceramics manufacturers entering the advanced ceramics industry, Table 20), annual energy consumption is estimated at 1.012 PJ. This value represents 39 per cent of the ceramics industry process energy share by the year 2000.

Energy conservation within the advanced ceramics industry, through the use of microwave technology, will save approximately 0.65 to 0.77 PJ annually. This value represents 25 to 30 per cent of the ceramics industry energy conservation potential by the year 2000.

CONCLUSION

Microwave technology appears to be of interest to a number of ceramics manufacturing companies. Microwave heating can be fast, uniform and efficient.

The application of microwave technology to the drying, sintering and bonding of ceramic materials are anticipated to demonstrate:

- reduced drying energy costs up to 60 per cent;
- reduced sintering costs up to 97 per cent;
- reduced electricity and natural gas consumption associated with conventional ovens and kilns;
- increased energy efficiency;
- reduced floor space requirements;
- reduced labour intensity;
- increased production yield up to 95 per cent;
- reduced operation bottleneck conditions.

The research results on microwave equipment, for the various stages of ceramics production, on five funded EnerSearch projects, will be published within the next 16 to 24 months.

Survey results indicate that the ceramics industry is an important and growing industry in Ontario. In particular, a significant growth in energy consumption may be encountered within the advanced ceramics industry.

The implementation of microwave technology, within the ceramics industry, has the potential ability to save up to 1.5 petajoules per year. The application of microwave technology can lead to the development of more reliable and better quality products. This in turn may impact on the development of more energy-efficient products constructed with ceramic materials.

Note: The following lists of companies are provided in alphabetic order. These lists do not correspond to the ordering within the matrix characteristics tables developed for each industry group.

TABLE 1: ONTARIO CERAMICS INDUSTRY COMPANIES

Manufacturers:	
° Glass	19
° Abrasives	45
° Traditional Ceramics	91
° Advanced Ceramics	12
° Others	42
Total	**209**
User Companies:	
° Glass	169
° Ceramics	46
Total	**215**
Distributors	78
Non-active	53
No Response to Survey	9
Total Companies in Ontario	**564**

TABLE 2: ONTARIO CERAMICS MANUFACTURERS

Industry	Number of Companies
Traditional:	
° Brick and Tile	9
° Electrical Porcelain	5
° Pottery (Large)	14
° Pottery (Medium)	12
° Pottery (Small)	38
° Refractories	13
° Sanitaryware	4
° Enamel	7
° Glazes	8
° Others	35
Total	**145**
Advanced:	
° Electrical	9
° Mechanical/Structural	2
° Powders	1
Total	**12**
Glass	19
Abrasives	45
Total	**209**

TABLE 3: BRICK AND TILE PLANTS

1.	Amos C, Martin Ltd.	Parkhill
2.	Brampton Brick Limited	Brampton
3.	Canada Brick Company Limited	Streetsville
4.	Clifton Ceramic Tiles Inc.	Kingston
5.	Great Lakes Ceramics Inc.	Thunder Bay
6.	Hamilton Brick Limited	Hamilton
7.	National Sewer Pipe Limited	Oakville
8.	Paisley Brick and Tile Company Limited	Paisley
9.	Windsor Ceramic Tile Canada Ltd.	Windsor

TABLE 4: BRICK AND TILE INDUSTRY PROFILE

Number of Employees	Product	Capacity (Millions)	Process	Kilns	Fuel Type	Hrs. of Operation
250	Glazed tiles	-	Hydraulic pressing	2	Gas	24h/d
165	Clay brick	80 units	Extrusion	4	Gas	29h/d
410	Clay brick	340 units	Extrusion	18	Gas	24h/d
35	Clay brick	10 units	Extrusion	5	Gas	9h/d
25	Brick tile	7 units	Extrusion	1	Gas	15h/d
40	Floor tiles	2 sq. ft.	Hydraulic pressing	1	Gas	29h/d
28	Floor tiles	8 " "	Extrusion	1	Gas	24h/d
10	Clay tiles	1 unit	Extrusion	2	Oil	8h/d
75	Linings, bricks	-	Extrusion	10	Gas	24h/d
1038				44		

Total annual energy consumption in this sector is estimated at 259.88 million kWh.

TABLE 5: ELECTRICAL PORCELAIN MANUFACTURERS

1.	Electro Porcelain Co. Ltd.	Waterloo
2.	Hamilton Porcelains Ltd.	Brantford
3.	Norceram Inc.	Ingleside
4.	Relmech Manufacturing Ltd.	Elmira
5.	Smith and Stone (1912) Inc.	Georgetown

TABLE 6: ELECTRICAL PORCELAIN INDUSTRY PROFILE

Number of Employees	Product	Capacity $ Sales (Millions)	Process	Kilns	Fuel Type	Hrs. of Operation
250	Insulators	-	Dry Press/ Extension	2	Gas	24h/d
70	Capacitors, Resistors	4.8	Compression	-	-	-
250	Insulators	-	Dry Press	2	Gas	24h/d
110	Insulators/Grids	6.0	Dry Press	2	Gas	24h/d
11	Insulators	-	Extrusion	1	Gas	12h/d
691				7		

Total annual energy consumption in this sector is estimated at 16.0 million kWh.

TABLE 7: POTTERY INDUSTRY (LARGE)

1.	A.R.C. Industries	St. Catharines
2.	Alan R. Daly Ltd.	Toronto
3.	Anthony's Art Design Limited	Toronto
4.	Canadian Art China Limited	Collingwood
5.	Ceramics Unlimited Inc.	Kitchener
9.	Clay Crafters Workshop	Oakville
6.	Cutler Brands and Designs	Toronto
7.	Edgewood Potteries Inc.	Toronto
8.	Elcyda Corporation Limited	Weston
9.	Elegant Lamp Ltd.	Mississauga
10.	Horizon Ceramics Supplies Limited	Erin
11.	Lawson Falle Limited	Cambridge
12.	Rainbow Ceramics Inc.	Collingwood
13.	Royal Ceramics Ltd.	Weston
14.	Sunrise Fine Bone China Co.	Toronto

TABLE 8: POTTERY INDUSTRY (LARGE) PROFILE

Number of Employees	Product	Capacity (Pieces)	Process	Kilns	Fuel Type	Hrs. of Operation
15	Lamps/vases etc.	60,000	Slip casting	4	Electric	24h/d
84	Mugs	-	Decorating/ firing	2	Electric	8h/d
12	Greenware	260,000	Slip casting	5	Electric	8-12h/d
20	Plates, mugs etc	-	Firing	6	Electric	6-10h/d
35	Lamps	9,600	Slip casting	19	Electric	6h/d
14	Giftware	3,000	Decor/firing	2	Electric	8h/d
38	Giftware	-	Decor/firing	6	Electric	24h/d
30	Vases, Lamps	26,000	Slip casting	3	Electric	24h/d
12	Giftware	72,000	Slip casting	3	Electric	24h/d
10	Vases, lamps	-	Slip casting	4	Electric	20h/d
40	Mugs, tiles	-	Decor/firing	4	Electric	20h/w
73	Giftware, lamps	-	Slip casting	4	Elec/Gas	24h/d
20	Porcelain/glass	-	Decor/firing	1	Gas	10h/d
20	Giftware	-	Slip casting	5	Electric	18h/d
423				68		

Total annual energy consumption in this sector is estimated at 7.07 million kWh.

TABLE 9: POTTERY INDUSTRY (MEDIUM)

1.	Alltrex China & Decorating Supply Ltd.	Thornhill
2.	Almaguin Highlands	Sundridge
3.	Burbank Potteries Ltd.	Pickering
4.	Clay Crafters Workshop	Oakville
5.	Donn Zver Pottery	Troy
6.	Fairview Ceramics	Burlington
7.	Forks Road Pottery	Wainfleet
8.	Jane's Pottery Factory	North Bay
9.	Jofi's Vase World Inc.	Toronto
10.	Northbound Stoneware Inc.	Kitchener
11.	Pic 'N' Do Ceramics Ltd.	Oakville
12.	Souvenir Canada	Downsview

TABLE 10: POTTERY INDUSTRY (MEDIUM) PROFILE

Number of Employees	Product	Capacity (Pieces)	Process	Kilns	Fuel Type	Hrs. of Operation
4	Figurines	-	Slip Casting	2	Electric	4-6h/d
5	Planters	-	Slip Casting	8	Electric	18-24h/d
7	Vases, Etc.	-	Slip Casting	1	Electric	5h/d
6	Mugs, Etc.	-	Decor/Firing	4	Electric	9h/d
5	Dinnerware	25,000	Handmade	3	Propane/ Electric	12-24h/d
6	Giftware	24,000	Slip Casting	3	Electric	3-9h/d
5	Earthenware	60,000	Slip Casting	8	Electric	14h/d
5	Whiteware	50,000	Slip Casting	5	Electric	10h/d
9	Vases, Platters	130,000	Slip Casting	6	Electric	5-8h/d
5	Whiteware	24,700	Slip Casting	4	Electric	24h/d
7	Crocks, Bowls	-	Handmade	1	Gas	12h/d
6	Greenware	-	Slip Casting	4	Electric	16h/d
70				48		

Total annual energy consumption in this sector is estimated at 1.82 million kWh.

TABLE 11: POTTERY INDUSTRY (SMALL)

1.	A & J Ceramics	Sault Ste Marie
2.	Agimak Ceramics	Ignace
3.	B.M. Headford Industries Ltd.	Scarborough
4.	Bailey Ceramics & Giftware	Sault Ste Marie
5.	Bostlund Industries Ltd.	Richmond Hill
6.	Canadian Ceramic Centre	Mississauga
7.	Country Town Tiles	Carleton Place
8.	D & M Ross Handcrafts Inc.	Beamsville
9.	E & A Ceramics	Ajax
10.	Elsie's Exclusives	Downsview
11.	Fryatt-Fairfax Company	Mississauga
12.	Galleon Ceramics	Windsor
13.	Grandeur Gifts	Rexdale
14.	Heritage Arts China	St. Catherines
15.	Krys & Wes Ltd.	Mississauga
16.	Lake Scugog Pottery Products Limited	Nestleton
17.	Leishman Pottery	Stayner
18.	Maisie's Ceramics	Preston
19.	Minerva Ceramics Inc.	Richmond Hill
20.	Minton Artware Inc.	Concord
21.	Nielsen's Ceramics	Midland
22.	Pinecroft Pottery	Aylmer
23.	Salem Pottery	Salem
24.	The Potters Four	La Salle
25.	The Pottery Studio	Collingwood
26.	Wyatt Art Pottery	Burlington

TABLE 12: REFRACTORIES MANUFACTURERS

1.	A.P. Green Refractories	Weston
2.	BMI Refractories Inc.	Smithville
3.	Babcock & Wilcox Refractories Ltd.	Burlington
4.	C-E Refractories (R&I Ramite (Canada)Ltd.)	Welland
5.	Frontier Refractories	Grimsby
6.	General Refractories Co. of Canada Ltd.	Smithville
7.	Industrial Ceramics Limited	Mississauga
8.	International Refractory Products Ltd.	Brantford
9.	National Refractories	Oakville
10.	Niagara Cast Linings Limited	Port Robinson
11.	North American Refractories Limited (Division of Allied Canada Inc.)	Caledonia
12.	Plibrico (Canada) Limited	Burlington
13.	William R. Barnes Co. Ltd.	Waterdown

TABLE 13: REFRACTORIES INDUSTRY PROFILE

Number of Employees	Product	Capacity (Tonnes)	Process	Kilns	Fuel Type	Hrs. of Operation
60	Castables	-	Extrusion/ dry press	-	-	-
123	Castables, Coatings	-	Dry Lending	-	-	-
14	Crucibles	-	Extrusion	4	Electric	12h/d
30	Castables	-	Extrusion	-	-	24h/d
20	Firebricks, Crucibles	-	Screw Press	5	Gas	24h/d
100	Firebricks	-	Dry Blendiaz	2	Gas	-
8	Castables	2 400	Dry Press	-	-	-
90	Castables	1,000,000	Extrusion/ dry press	-	-	-
55	Ladle covers	-	Castings	-	-	-
60	Castables	-	Dry Lending	-	-	-
30	Castables	10,400	Dry Lending	-	-	-
5	Cast linings	-	-	-	-	-
30	Castables	-	Extrusion/ dry blend	-	-	-
70	Castables	22,500	Extrusion/ dry blend	2	Gas	6-12h/w
695				15		

Total annual energy consumption in this sector is estimated at 49.4 million kWh.

TABLE 14: SANITARYWARE MANUFACTURERS

1.	American Standard Ltd., Division of Wabco	Toronto
2.	Crane Canada Inc.	Trenton
3.	MBM Ceramics Ltd.	Toronto
4.	Waltec Bathware (Division of Emco Ltd.)	Cornwall

TABLE 15: SANITARYWARE INDUSTRY PROFILE

Number of Employees	Product	Capacity (Pieces)	Process	Kilns	Fuel Type	Hrs. of Operation
30	Sanitaryware	62,000	Slip casting	2	Gas	24h/d
590	Sanitaryware	400,000	Slip casting/ press	8	Gas/Elec	24h/d
71	Sanitaryware	3,120,000	Slip casting	3	Electric	24h/d
100	Sanitaryware	200,000	Slip casting	2	Gas	24h/d
791				15		

Total annual energy consumption in this sector is estimated at 113.8 million kWh.

TABLE 16: GLAZING COMPANIES

1.	Alcan International Ltd.	Kingston
2.	Canada Vitrified Products Limited	St. Thomas
3.	Chicago Vitreous (Canada) Limited	Ingersoll
4.	Ferro Industrial Products Limited	Oakville
5.	Graham Bell and Associates	Georgetown
6.	Halton Ceramics Ltd.	Burlington
7.	Vitrex Ceramics Ltd.	Burlington
8.	Wagner Signs Inc.	Toronto

TABLE 17: GLAZING INDUSTRY PROFILE

Number of Employees	Product	Capacity Sales ($ Millions)	Process	Kilns	Fuel Type	Hrs. of Operation
-	Powders	-	-	-	-	-
60	Decorative Prods	-	-	2	Gas	24h/d
8	Plaster moulds	-	-	-	-	-
20	Industrial Ceramics	1	Extrusion	8	Gas	VAR
150	Glazes, Coatings	-	-	2	Gas/Elec	24h/d
25	Glazes, Enamel	-	Smelting	3	Gas	24h/d
23	Linings	-	Extrusion	5	Gas	VAR
72	Porcelain Enamel	8-9	-	1	Electric	24h/d
358				21		

Total annual energy consumption in this sector is estimated at 75.6 million kWh.

TABLE 18: CERAMICS MANUFACTURERS (OTHERS)

1.	Acme Strapping Inc.	Scarborough
2.	Air Products	Brampton
3.	Bell Northern Research	Ottawa
4.	Blythe Matthey Ltd.	Brampton
5.	Canada Colours & Chemicals	Don Mills
6.	Canadian Ceramic Services	Vittoria
7.	DeGussa Canada Ltd.	Burlington
8.	Dominion Brick & Tile Machinery	Markham
9.	Dominion Colour	Toronto
10.	Durie Tile & Terrazzo Ltd.	Ottawa
11.	EEV Canada Ltd.	Rexdale
12.	Farr Acidproofing & Refractories Ltd.	Mississauga
13.	Fisher Scientific Co. Ltd.	Nepean
14.	Galt Wood Tools Ltd.	Cambridge
15.	Granolite Co. Ltd.	Bolton
16.	Graphic Screen Advertising Ltd.	Toronto
17.	H. L. Taylor Enterprises	Willowdale
18.	Incinco Ltd.	Burlington
19.	Industrial Process Control Ltd.	Toronto
20.	Joan Ann Ceramics	Brampton
21.	Kingsley & Keith (Canada) Ltd.	Etobicoke
22.	Long Manufacturing Ltd.	Oakville
23.	M & T Chemicals Ltd.	Hamilton
24.	Northern Pigment Company	Toronto
25.	Northern Pottery	Chapleau
26.	Ontario Chemical Co.	Thorold

TABLE 18: CERAMICS MANUFACTURERS (OTHERS) (Cont'd)

27.	Ordan Thermal Products Ltd.	Markham
28.	Pottery Supply House (Ltd), The	Oakville
29.	Prescott & Co. Ltd.	Mississauga
30.	Riverside Refractories Canada Ltd.	Sault Ste. Marie
31.	Runnalls Plumming & Industrial	Brampton
32.	Servco Refractories Inc.	Burlington
33.	Signode Canada Ltd.	Scarborough
34.	Stratford Clay Supply Ltd.	Stratford
35.	Supplies Ltd.	Brampton
36.	Tosca Tile Ltd.	Kitchener

TABLE 19: ADVANCED CERAMICS MANUFACTURERS

1.	Alcan International Ltd.	Kingston
2.	Almax Industries Limited	Lindsay
3.	BM Hi-Tech	Collingwood
4.	Ceramics Kingston	Kingston
5.	Com Dev Ltd.	Cambridge
6.	EYC Technical Ceramics Ltd.	Espanola
7.	Electrofuel Manufacturing Co.	Toronto
8.	Jay-em Ceramics	Brampton
9.	Lakeside Electronics Limited	Whitby
10.	Lapp Insulators Inc.	Hamilton
11.	Murata Erie North America Ltd.	Trenton
12.	Neosid (Canada) Limited	Toronto
13.	Thermalloy Corporation	Thornhill

TABLE 20: ADVANCED CERAMICS INDUSTRY PROFILE

Number of Employees	Type of Product	Percent Powder Imported	Number of Kilns	Fuel Type	Hrs. of Operation
5	Electronic	100	6	Electric	12h/d
14	Powders	100	1	Electric	16h/d
6	Mechanical/ Structural	80	3	Electric/ Gas	8h/d
230	Electrical	-	1	Electric	12h/d
8	Electrical	0	8	Electric	8h/d
80	Electrical	0	7	Gas	24h/d
8	Structural	80	2	Gas	Var
20	Electrical	100	18	Electric	-
880	Electrical	100	8	Electric	24h/d
113	Electrical	100	4	Gas	Var
5	Coatings	-	-		
1,367			58		

Total annual energy consumption in this sector is estimated at 5.9 million kWh.

TABLE 21: INDUSTRIAL USERS OF ADVANCED CERAMICS

1.	ITT Cannon	Whitby
2.	Able Gasket & Materials Ltd.	Concord
3.	Arolab Instruments Ltd.	Windsor
4.	Algoma Steel Corporation Ltd.	Sault Ste. Marie
5.	Atlas Engineering & Machine Co. Ltd.	Toronto
6.	Atomic Energy of Canada Ltd.	Mississauga
7.	BV Tool Co. Ltd.	Sarnia
8.	Bendix Electronics	Chatham
9.	Bimac Canada Metallurgical Ltd.	Burlington
10.	Camco Inc.	Hamilton
11.	Can-Eng Mfg. Ltd.	Niagara Falls
12.	Can Mar Manufacturing	Niagara Falls
13.	Canadian Stebbins Engineering & Manufacturing Co. Ltd.	Ottawa
14.	Cercor Inc.	Georgetown
15.	Clark Procelain Co.	Mississauga
16.	Dofasco Inc.	Hamilton
17.	Durametallic Canada Inc.	St. Thomas
18.	Engelhard Industries	Aurora
19.	Epitek International	Kanata
20.	F S Tool Corp.	Markham
21.	GSW Water Products Company	Fergus

TABLE 21: INDUSTRIAL USERS OF ADVANCED CERAMICS (Cont'd)

22.	Garland Commercial Ranges Ltd.	Mississauga
23.	Garrett Manufacturing Ltd.	Rexdale
24.	Gasmac Inc.	Mississauga
25.	Inglis Limited	Stoney Creek
26.	Iscar Tools Inc.	Oakville
27.	Jacot Company	Kingston
28.	Kennametal Ltd.	Toronto
29.	Kenroe Tools Corp.	North Bay
30.	Litton Systems Canada Ltd.	Etobicoke
31.	London Precision Machine & Tool Ltd.	London
32.	Microtel Ltd.	Brockville
33.	Mitel Corporation	Kanata
34.	Northern Telecom	Nepean
35.	Peacock Inc.	Mississauga
36.	Powerplex Technologies	Downsview
37.	Pyrotenax of Canada Ltd.	Trenton
38.	Reuter-Stokes Canada Ltd.	Cambridge
39.	Rheem Canada Limited	Hamilton
40.	Specialty Cast Metals Ltd.	Niagara Falls
41.	Steetley Talc Ltd.	Timmins
42.	Stelco Inc.	Hamilton
43.	Synergetic Technologies	Oakville
44.	Thermosafe Industries	Hamilton

TABLE 22: POTENTIAL USERS AND MANUFACTURERS OF ADVANCED CERAMICS IN ONTARIO

1.	Advanced Chemical Systems	Mississauga
2.	AE Autoclave Canada Ltd.	Burlington
3.	Alcan International Ltd.	Kingston
4.	ASEA Inc.*	Mississauga
5.	Atomic Energy of Canada Ltd.	Chalk River
6.	Canadian General Electric*	Trenton
7.	Cominco*	Mississauga
8.	Contour Computer Corp.	Toronto
9.	Devilbiss (Canada) Ltd.	Barrie
10.	Dofasco*	Hamilton
11.	Dominion Colour Co.	Toronto
12.	Dow Corning Canada Inc.	Mississauga
13.	Dupont Canada Inc.	Ajax
14.	Energy Dynamics Inc.	Woodbridge
15.	Epitek Electronics**	Kanata
16.	Ernst Leitz Canada	Midland
17.	Esso Petroleum of Canada	Sarnia
18.	Falconbridge*	Orillia

TABLE 22: POTENTIAL USERS AND MANUFACTURERS OF ADVANCED CERAMICS IN ONTARIO (Cont'd)

19.	Ford Motor Company Ltd.	Oakville
20.	Foseco Canada Inc.	Guelph
21.	F & S Tool Corp.	Markham
22.	Fiberglas Canada Inc.	Sarnia
23.	Electrovert Ltd.	Toronto
24.	Galtwood Tools**	Cambridge
25.	Garrett Canada	Rexdale
26.	General Motors of Canada**	Oshawa
27.	George A. Wright & Sons (JA - Division)**	Kingston
28.	Graff Diamond Products Ltd.**	Brampton
29.	Hamilton Porcelains	Brantford
30.	Howden Group Canada Ltd.	Scarborough
31.	IBM*	Markham
32.	Inco Ltd.	Mississauga
33.	Indal Technologies Inc.	Mississauga
34.	Industrial Ceramics Ltd.	Mississauga
35.	Iron Ore Company of Canada	Scarborough
36.	J.K.S. Boyles International Inc.**	Toronto
37.	Kennametal Limited**	Toronto
38.	Kenrock Tools Inc.**	Toronto
39.	Lapp Insulators	Hamilton
40.	Lasco*	Oshawa
41.	Leeds and Northrun Canada	Rexdale
42.	Litton Systems Canada Ltd.	Toronto
43.	Magna International	Markham
44.	Morganite Canada Inc.	Toronto
45.	Noranda*	Toronto
46.	PPD Technologies	Toronto
47.	Peacock Inc.**	Cookesville
48.	Phillips Cables Ltd.**	Brockville
49.	Polysar Limited	Sarnia
50.	Pratt and Whitney Canada Inc.	Mississauga
51.	Sandvik Canada Corp.**	Mississauga
52.	Stelco	Hamilton
53.	Synergetic Technologies	Oakville
54.	TransCanada Pipeline Ltd.	Toronto
55.	Tridon North America	Oakville
56.	Union Carbide*	Welland
57.	Velenite Modco Limited**	Windsor
58.	Volkswagen Canada Inc.	Hamilton
59.	W.R. Grace & Company of Canada Ltd*	Ajax
60.	Westinghouse Canada Inc.	Hamilton

* Companies listed in Ontario Hydro publication - ref. 7
**Companies listed in Advanced Ceramics - ref. 8

APPENDIX A

COMPANIES MANUFACTURING ABRASIVES

1.	Adamas Laboratory Corp.	Windsor
2.	Airwick of Canada	Markham
3.	Alliance Abrasive Wheel Ltd.	Niagara Falls
4.	Bay State Abrasives (Div. of Dresser Canada Inc.)	Brantford
5.	Buller Buff Co. Inc.	Galt
6.	Canadian Carborundum Co. Ltd.	Niagara Falls
7.	Canadian Grinding Wheel Co. (Div. of Auto Crown Corp. Ltd.)	Hamilton
8.	Carbon and Filtration Products	Islington
9.	Carborundum Abrasives Inc. Canada	Plattsville
10.	Carborundum Pulpstones Inc.	Niagara Falls
11.	Cavalier Manufacturing & Packaging Ltd.	Brantford
12.	Chrysler Canada Ltd.	Stratford
13.	Conestoga Bag'n Wheel Corp.	Hespeler
14.	Dresser Canada Inc.	Mississauga
15.	Dualflex Company Ltd.	Oldcastle
16.	Empro Manufacturing Inc.	Brampton
17.	Exolon Company of Canada Ltd.	Thorold
18.	Firecraft Kilns and Ceramic Supplies Inc.	Oakville
19.	Flex-O-Lite of Canada Ltd.	St. Thomas
20.	G. A. Fuller & Son Ltd.	Cambridge
21.	Gemtex Company Ltd.	Rexdale
22.	General Abrasive (Canada) Ltd.	Niagara Falls
23.	Hermes Abrasive (Canada) Ltd.	Mississauga
24.	JKS Boyles International Inc.	Toronto
25.	Kentrex Inc.	Brampton
26.	Kilian Manufacturing Ltd.	Toronto
27.	M. Kohen	Toronto
28.	Mid-West Abrasives Co. of Canada Ltd.	Strathroy
29.	Miles Laboratories Ltd.	Rexdale
30.	Nortel Manufacturing Ltd.	Scarborough
31.	Norton Company of Canada Ltd.	Niagara Falls
32.	Nuryshah Enterprises Ltd.	Concord
33.	Orlick Industries Ltd.	Hamilton
34.	Roth Diamond Tools	Rexdale
35.	Standard Oils Electro-Minerals Co.	Niagara Falls
36.	Studley Canada Ltd.	Toronto
37.	Thomas Abrasives Products Inc.	Oakville
38.	Thomas Wire Die Ltd.	Burlington
39.	G. F. Thompson Co. Ltd.	Newmarket
40.	3M Canada Inc.	London
41.	Universal Grinding Wheel (Div. of Unicorn Abrasives of Canada)	Brockville
42.	VIP Industry Inc.	Brampton
43.	Washington Mills Ltd.	Niagara Falls
44.	W. W. Wells Ltd.	Scarborough
45.	Wright Abrasives (1970) Inc.	Hamilton

APPENDIX B

GLASS MANUFACTURERS

1.	William R. Barnes Co. Ltd.	Waterdown
2.	Beachvilime	Beachville
3.	Consumers Glass Co. Ltd.	Toronto
4.	Diversey Wyandutte Ltd.	Mississauga
5.	Domglas Inc.	Mississauga
6.	Fiberglas Canada Inc.	Toronto
7.	Ford Glass Ltd.	Toronto
8.	Glasrock Products of Canada Ltd.	Hamilton
9.	Graham Fiber Glass Ltd.	Erin
10.	Guardian Industries Ltd.	Tillsonburg
11.	Johns-Manville Canada Inc.	Etobicoke
12.	Libbey St. Clair Inc.	Wallaceburg
13.	M & T Chemicals Ltd.	Hamilton
14.	National Silicates Ltd.	Toronto
15.	PPG Canada Ltd.	Owen Sound
16.	Quality Hermetics Co. (Div. Leigh Instruments Ltd.	Toronto

APPENDIX C

ENAMELING COMPANIES

1.	Clare Brothers Ltd.	Cambridge
2.	GSW Ltd.	London
3.	Inglis Ltd.	Stoney Creek
4.	McGraw-Edison of Canada Ltd.	Toronto
5.	Rheem Canada Ltd.	Hamilton

APPENDIX D

LISTED COMPANIES, NON-ACTIVE

1.	Home Technics Ltd.	Peterborough
2.	H & R Johnson (Canada) Inc.	Hamilton
3.	Dux Delux Ceramics Studio	Toronto
4.	Aristocrat Lamps & Lighting Ltd.	Toronto
5.	Canadian Porcelain Company Ltd.	Hamilton
6.	George Coultis & Son Limited	Not found
7.	Deller's Tile Ltd.	Brownsville
8.	Disty Rep Component Sales Inc.	West Concord
9.	Dochart Brick & Tile Company Ltd.	Arnprior
10.	Dresden Tile Yard Limited	Dresden
11.	Engineered Refractories of Canada	Sault Ste. Marie
12.	Gralldon Ltd.	Iroquois
13.	IFOJ Industries	Toronto
14.	Inland Refractories Canada Ltd.	Stoney Creek
15.	McMaster Pottery Limited	Dundas
16.	Meaford Tile Ltd.	Meaford
17.	The Rocking Horse Studio	Elmira
18.	Rydall Brick & Tile Limited	Not found
19.	Spinel Technology Inc.	Thorald
20.	N. S. Bauman Limited	Wallenstein
21.	Domtar Construction Materials Ltd. (Clay Products Division)	Not found Mississauga
22.	Heritage Silversmiths Limited, Blue Mountain Pottery Division	Collingwood
23.	Trans Canada Electronics Ltd.	Scarborough
24.	Allord Manufacturing & Supply Co. Ltd.	Kitchener
25.	Beach Appliances International Ltd.	Ottawa
26.	Beaver River Potteries Ltd.	Scarborough
27.	Canadian Ohio Brass Company Ltd.	Niagara Falls
28.	Canadiana Pottery Limited	Ingleside
29.	Chemical Group, Ind., Minerals Div.	Havelock
30.	D.H.I. Limited, Porcelain Division	Brampton
31.	Diamond Clay Products Limited	Burlington
32.	Eastern Pottery Limited	Cornwall
33.	Electronic Components International Div. of Edward R. Steger Associates	Markham
34.	Elwell Pottery	London
35.	Fejer Ceramics	Downsview
36.	G. B. Distributors	Burlington
37.	Kelvinator of Canada Limited	London
38.	Milton Brick Co., Division of Milton Group Limited	Milton
39.	Natco Building Products Limited	Burlington
40.	Parkhill Brick and Tile Company	London
41.	Powers-Fiat Products of Canada, Ltd.	Orillia
42.	Reptronics Limited	Markham
43.	Riedel's Pottery Shop	Peterborough
44.	Salt & McKee Ltd.	Thornhill
45.	Toronto Pottery, Supplies & Service	Mississauga
46.	United Ceramics Limited, Toronto Brick Division	Toronto
47.	Westwood Bros. Limited	Toronto
48.	D. A. White & Co. Ltd., Frontenac Tile Division	Kingston
49.	White Oak Pottery	Milton

APPENDIX E

COMPANIES INVOLVED IN THE SALES AND DISTRIBUTION OF CERAMIC MATERIALS AND COMPONENTS

1.	Alcoa International Canada Ltd.	Mississauga
2.	Alphatherm Inc.	Concord
3.	Amcar Metals Limited	Mississauga
4.	Anbak Sales (Canada) Ltd.	Oakville
5.	Andersen Dynamics Ltd.	Markham
6.	Ashbury Wilkinson Graphite & Foundry Supply Co.	Toronto
7.	Baknor Industries Ltd.	Mississauga
8.	Barclay Lamps	Mississauga
9.	Bond-Collins Ltd.	Hamilton
10.	W.A. Bond Ltd.	Welland
11.	Burlington Ceramics & Supply	Burlington
12.	Burnstein Brick Limited	St. Catharines
13.	Cana-Roma Ceramic Importers Ltd.	Concord
14.	Canada Cement Lafarge Ltd.	Don Mills
15.	Canlab American Hospital Supply CDA Inc.	Mississauga
16.	Cantwell & Company	Oakville
17.	Carborundum	St. Catharines
18.	Ceraheat Industries Limited	Port Robinson
19.	Ceramics Arts Limited	Burlington
20.	Ceraminca Tile Centre Ltd.	Mississauga
21.	Chandler Industrial Supplies Ltd.	Toronto
22.	Chesterton Co. Ltd.	Burlington
23.	Conval Quebec	Etobicoke
24.	Corning Glass Inc.	Toronto
25.	Deskin Sales Corp.	Markham
26.	Detrick Co. of Canada Ltd.	Don Mills
27.	Didier Refractories Corp.	Burlington
28.	Diemould Service Co. (Canada) Ltd.	Scarborough
29.	Doughty Concrete Products Ltd.	Peterborough
30.	Doulton Canada Inc.	Scarborough
31.	Dynatronix Ltd.	Scarborough
32.	Electro Sonic Inc.	Willowdale
33.	Empire Carbide Engineering Ltd.	Toronto
34.	F.A.G. Bearings Ltd.	Stratford
35.	Hamer Gauge & Tool Ltd.	Windsor
36.	HI-Q Lighting & Gauge Ltd.	Don Mills
37.	Hoskin Scientific Ltd.	Oakville
38.	IPM National Hose	Scarborough
39.	ITT Components Division, ITT Industries of Canada Ltd.	Concord
40.	Jackson Tool & Engineering	Brampton
41.	Jobmaster Magnets Canada Inc.	Mississauga
42.	Johns Scientific Inc.	Toronto
43.	Johnston Silver Craft Ltd.	Toronto
44.	Leco Instruments Ltd.	Mississauga
45.	MacDowell Cement Products Ltd.	Brockville
46.	Manville Canada Inc.	Etobicoke
47.	McHugh Electronics Ltd.	Pickering

48.	Metco Canada Division	Rexdale
49.	Napanee Brick and Tile Works Ltd.	Napanee
50.	Norwich Brick & Tile Ltd.	Norwich
51.	OEM Sales	Rexdale
52.	Ontario Tile & Ceramics Ltd.	Markham
53.	Paisley Products of Canada Inc.	Scarborough
54.	Patterson Industries (Canada) Ltd.	Scarborough
55.	Pelko Electric Ind.	Toronto
56.	Philips Electronics Ltd.	Scarborough
57.	Rae Industrial Electronics Ltd.	Downsview
58.	Ritchey Supply Ltd.	Mississauga
59.	Robinson (Clay) Products Ltd.	Concord
60.	SKF & Dormer Tools of Canada Ltd.	Mississauga
61.	James Sadler & Sons (Canada) Ltd.	Richmond Hill
62.	Sandvick Canada Inc.	Mississauga
63.	Saynor Jarah Inc.	Don Mills
64.	Scarborough & Grant Co. Ltd.	Weston
65.	A.C. Simmonds & Sons Ltd.	Pickering
66.	SB Simpson Ltd.	Burlington
67.	Spectrum Abrasives Ltd.	Rexdale
68.	Sprague Electric of Canada Ltd.	Downsview
69.	Subtel Ltd.	Ottawa
70.	Thames Valley Brick & Tile Div., Gravor Ltd.	Toronto
71.	Thunderbrick Limited	Thunder Bay
72.	Tool & Cutter Supply Co.	London
73.	Valenite - Modco Ltd.	Windsor
74.	Votron Electronics Inc.	Concord
75.	Webster & Sons Ltd.	Toronto
76.	Westburne Electric Supply Ltd.	Downsview
77.	Williams & Willson Ltd.	Scarborough
78.	Zesta Engineering Ltd.	Toronto

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